

Civil Engineering

Title: Development of a Comprehensive Water Audit

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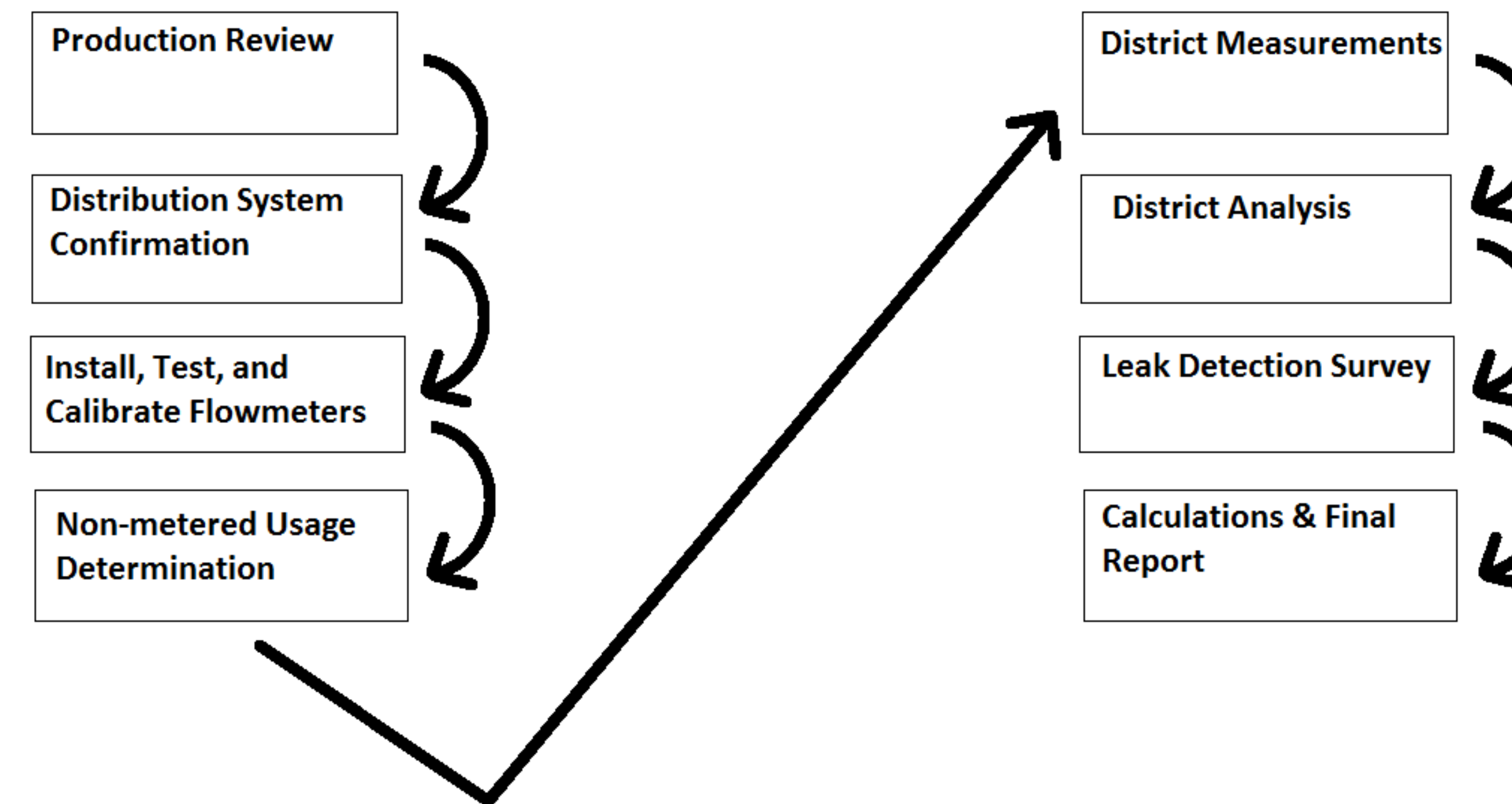
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Abstract

A water audit was conducted at an industrial beverage production facility near Sanger, Calif. to investigate a water distribution system that periodically is unable to meet demands, consumes large quantities of water at substantial cost, and was believed to have design inefficiencies and unknown uses and/or losses. Preliminary results confirm the existence of design inefficiencies and revealed that the evaporation and filtration processes require the most water, blending/filling processes require the second most water, and the plastics/bottling processes require the least amount of water. Unaccounted water use was found to be 27%. Both design and operational recommendations were made that are expected to reduce water use by 20-30%.

Overview



Purpose

The purpose of a water audit is to collect water consumption data for a given system and analyze the data based on efficiency, allotment, and waste. The beverage company involved with the water audit has room for improvement in all 3 areas.



In this particular case, a water balance was included in the water audit because the beverage company would also like recommendations on how to modify the distribution/drainage design to be more sustainable.



Site Conditions and Computer Modeling

Existing process plans were updated for the various systems in the beverage plant. New process flow diagrams were created as well as scaled site and utility plans for accurate reference. The scaled site plans were vital to proper placement of the flowmeters.



AutoCAD and Bentley WaterGEMS software was used in the study. WaterGEMS was used to model the water system using real time simulations. Alterations to the system in the model were explored to predict effects on the real system, E.g. pressure drops from removal of a lift station.

Equipment and Installation

Inline self-recording flow meters were installed at source pipes within the beverage production facility and calibrated to ensure accuracy. A total of 8 flow meters ranging in size from 2"-4" were used. The meters were strategically located (on specific pipes) so the data can be segregated and flow of different processes can now be determined.



Flowmeters were made of stainless steel (food grade). Experienced welding contractors performed the installations. All calibration and installation occurred before the harvest season (a critical water use period).

Site Study and Data Collection

A site study was performed to verify that all incoming pipes were metered and that it was possible to isolate the different processes. Flow data was collected from October through February when the beverage plant was active in tandem with extraction processes.



Substantial effort was expended on identifying all possible water uses and incorporating them into the analysis. Even so, results of the analysis revealed that a significant fraction of the water remained unaccounted for.

Data and System Analysis

Both the flow data and the allotment data were analyzed in this study. Flow data was analyzed in order to determine peak water demands and storage tank capacity. Allotment data was analyzed to determine destination of water volumes and water use efficiency.



While there were some discrepancies, mostly with water allotment, these discrepancies (unaccounted for water usage values) were expected and incorporated into the overall analysis.



Results

After recording the data and analyzing the flows, flow rates range from 10 gpm to 500 gpm for the system as a whole (a summation of all sub-processes). The evaporation/filtration processes use the most water during the study period, followed by boiler use, blending/filling, and finally plastic bottle creation. Recommended improvements include:

- Installation of a properly sized surge tank and additional pumps
- Piping changes
- Operational changes in wash down techniques
- Recycling of leuter water for boiler use

After these recommendations are implemented, water use is estimated to reduce by 20-30% and the risk of experiencing insufficient system capacity in the near-term will be negligible.

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